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for the year 1939

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DEPARTMENT OF AGRICULTURE.

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Northern Rhodesia.

DEPARTMENT OF AGRICULTURE.

Annual Report for the Year 1939.

FOREWORD.

The aims of the Department of Agriculture are the encouragement of European settlement on the land and the permanent raising of the standard of living of the indigenous rural population. The extent of European settlement is governed by the internal demand for European produce and by the very limited possibilities of profitable export. The main problems of European farmers are unquestionably more economic than agronomic in character, and in recent years the department has largely confined its assistance to the promotion of more orderly marketing and to the development of export crops. The raising of the standard of living of the indigenous population is an urgent problem and the production of cash crops has a special importance in this Territory in relation to the drift of adult males from the villages.

The following are regarded as the primary agricultural needs of the Territory, in order of precedence :

(1) The development of production by Europeans and Africans of crops which can be sold, concurrently with the introduction of measures to ensure that the land on which such crops can be grown shall remain permanently productive.

(2) The protection of areas the denudation of which would have serious effects on the Territory as a whole.

(3) The preservation of Native Reserves in areas excluded by geographical position from (1) and which are isolated from Crown Land.

(4) The general amelioration of subsistence agriculture in other areas (in order of their need) with a view to improving nutrition and the general standard of living.

(In (1), (3) and possibly (2), the development of economic crops and/or agricultural extension work will automatically lead to the improving of nutrition and the standard of living.)

In accordance with these aims and general considerations the following policy directs the activities of the department. Under each head is given a brief summary of the progress already achieved. More detailed accounts of earlier progress will be found in preceding annual reports. The figures in brackets refer to the relevant paragraphs of this report.

(a) *To explore the possibilities of agricultural development within the Territory generally.*

One aspect of this matter is covered by the Ecological Survey, now nearing completion. The economics of agricultural development have been discussed in two reports submitted to and adopted by the Agricultural Advisory Board, *viz.*, " The replacement of agricultural imports by local production, 1936 " and " The development of export crops, 1937 ".

(b) *To provide an agricultural advisory and crop improvement service and to this end to conduct such experiments as may be necessary.*

Tobacco ... ... (11, 29 to 31).
Coffee ... ... (32).
Cotton ... ... (33-36).
Beeswax ... ... (37-39).
General ... ... (40-45).

(c) *To raise the general standard of living of the indigenous population through the improvement of nutrition and, where possible, through the development of cash crops and, concurrently, to take steps to ensure that increased production does not lead to soil deterioration.*

It is obvious that in a territory of this size and which, generally, is very thinly populated, attention cannot be paid to all parts simultaneously. Consequently departmental effort is at present confined to those areas included in categories 1, 2 and 3 above. (46 to 50, 89 to 91.)

(d) *To promote the orderly marketing of established crops, to provide marketing arrangements during the interim between experimental and commercial production of new crops and thereafter to safeguard the interests of producers when such crops are bought commercially.*

The progress made under this head includes :

Establishment of Maize Control, 1936.
Establishment of Tobacco Boards and control of tobacco exports, 1936.
Establishment of compulsory Tobacco Auctions (Eastern Area), 1939.
Scheme for development of production of groundnuts and beans, 1937. (7)
Purchase of cotton and native tobacco crops, and, in certain areas, beeswax. (30, 31, 36.)

(e) *To co-operate with departments, unofficial institutions and Native Authorities in all matters in which agriculture plays a direct or indirect part.*
(44, 48, 49, 53, 56 to 58.)

AGRICULTURE IN THE TERRITORY.

1. After a long and almost unbroken succession of years of low rainfall, culminating in two abnormally dry years, a season of heavy rains came as a welcome relief. Unfortunately the rainfall was badly distributed ; the early rains were very scanty and the almost continuous rain in February and March played havoc with the unavoidably late planted crops. On the other hand, water supplies and grazing benefitted considerably and, on the whole, the year was a good one for European farmers except for those mainly dependent on maize.

Maize.

2. The European maize crop was again a poor one and the acreage was below normal chiefly on account of the difficult planting season. Deliveries to the Maize Control Board amounted to 153,000 bags, a decline of 3,000 bags on deliveries of the previous season.

3. The following is a comparative table of European maize production :

MAIZE PRODUCTION (EUROPEAN).

	Kalomo	*Mazabuka*	*Lusaka*	*Chisamba*	*Fort Jameson*	*Other Districts*	*Total*
1938-39 :							
Acres planted ...	1,074	13,465	15,671	7,626	155	814	38,805
Yield in bags ...	3,096	80,162	61,442	54,371	808	4,541	204,420
Yield per acre ...	2.9	6.0	3.9	7.1	5.2	5.6	5.3
1937-38 :							
Acres planted ...	939	14,031	17,114	8,326	221	1,474	42,105
Yield in bags ...	3,687	89,430	66,323	39,200	1,319	6,065	206,024
Yield per acre ...	3.9	6.4	3.9	4.7	6.0	4.1	4.9
Increase (+) *or Decrease* (—) *in* 1938-39 :							
Acres planted ...	+135	—566	—1,443	—700	—66	—660	—3,300
Yield in bags ...	—591	—9,268	—4,881	+15,171	—511	—1,551	—1,604
Yield per acre ...	—1.0	—0.4	—	+2.4	—0.8	—1.5	+0.4

4. The Native maize crop suffered much more severely from the fickleness of the weather. As usual planting continued far into the season but the gamble with late maize did not come off as the plants were waterlogged at a vital stage. The crop acquired by the Control Board was only some 64,000 bags. This is only one

half of the amount acquired in the previous year and less than one quarter of that acquired in 1936. Very little maize was offered for sale at the Mission and Pemba depots and in parts of this zone the crops reaped were barely sufficient for domestic requirements. The over-all yield is estimated at about $2\frac{3}{4}$ bags per acre, of which slightly over 2 bags would be required for domestic consumption.

5. The decline in European and Native production has coincided with a remarkable increase in local consumption and this has turned a substantial export surplus into a deficit which has had to be made good by imports. Since the institution of maize control in 1936 total production for sale has fallen from over 500,000 bags to 217,000 bags, while internal consumption (exclusive of farm and domestic consumption) has increased from just over 200,000 bags per annum to about 340,000 bags. These figures are deceptively alarming. One good season would reverse the present position and at the time of writing there is every hope that the new crop will be ample for internal requirements. With the Native crop alone it is estimated that an increase in yield of 1 bag per acre would bring 100,000 additional bags on to the market.

Wheat.

6. The replenishment of water supplies, which had fallen alarmingly during the last few years, enabled the acreage under Wheat to return to normal. 2,900 acres were planted and 13,500 bags were harvested, of which 12,000 were available for sale. This may be taken as a normal figure for production and no substantial permanent increase is likely to be secured unless new areas can be brought under irrigation. The current internal requirements of flour are equivalent to approximately 34,000 bags of wheat.

Groundnuts and Beans.

7. Encouraging progress was made under the scheme for developing the production of nuts and beans. Local purchases are estimated at 5,000 bags of beans and 1,000 bags of nuts, the vast bulk of which represents new production since the inception of the scheme. About 2,000 bags of beans came from Serenje district which produced practically nothing for sale two years ago. There is still plenty of room for expansion for the requirements of the territory approximate to 14,000 bags of beans and 6,000 bags of nuts. In the railway belt, production of these crops suffers from competition with maize though the attitude of the cultivators should change when the rotational value is more fully appreciated. Development of production in more remote districts is proceeding steadily, a most welcome sign as these districts have little opportunity for emerging from subsistence agriculture.

Potatoes.

8. Production of main crop potatoes increased from 2,800 bags to 4,300 bags of which 3,500 bags were available for sale. Usually the territory is dependent on imports for irrigated potatoes which supply the market from August to February. This year, however, increased water supplies permitted abnormally large production of the late irrigated crop which is marketed toward the end of the period, and for a time local supplies were more than sufficient. As irrigated potatoes will not keep, considerable quantities had to be fed to pigs and a low price was received for those which were sold.

Tobacco : Eastern Area.

9. The outstanding event of the year was the inauguration of compulsory auction sales at Fort Jameson. Some minor difficulties were experienced over the allocation of proceeds of quota sales but the auctions were carried through with amazing smoothness and rapidity. The organisation was a triumph for the Eastern Tobacco Board and the owners of the auction floor. The season was not a particularly good one and yields showed a slight decline, though quality on the whole was well maintained. Competition was keen, particularly for full bodied tobacco, and the auction system enabled planters to reap the full benefit of the rise in prices.

10. In all some 1,840,000 lbs. of leaf (wet weight) were sold by auction at an over-all price of 11.29 pence per lb. Of this quantity 376,000 lbs sold under the Union quota fetched an average of 25.08 pence per lb. and the balance averaged 7.75 pence. There was an over-all increase in price of 2 pence per lb. on the proceeds of last season. A small quantity was exported on consignment.

Tobacco : Western Area.

11. The season in the Railway Belt was particularly difficult and the comparative failure of some crops led to a disappointing average yield. In spite of this there were encouraging features. One grower, who followed exactly the advice given by Mr. Cowling, was rewarded with a magnificient crop and a number of others also did well. All saleable tobacco was disposed of at satisfactory prices. Some of the best leaf was sold on sample to a firm in the United Kingdom. This firm has since offered to take the bulk of the coming crop. Government continued to subsidise the appointment of Mr. Cowling, Manager of the Tobacco Co-operative Society, for his advisory services.

12. The following is a comparative table of flue cured tobacco production :—

VIRGINIA TOBACCO (FLUE CURED.)

	Western Area	*Eastern Area*	*Total*
1938-39 :			
Acres planted	295	3,950	4,245
Yield in pounds	105,000	1,855,000	1,960,000
Yield per acre	356	470	462
1937-38 :			
Acres planted	226	3,680	3,906
Yield in pounds	113,000	1,883,000	1,996,000
Yield per acre	500	512	511
Increase (+) *or Decrease* (—) *in* 1938-39 :			
Acres planted	+69	+270	+339
Yield in pounds	—8,000	—28,000	—36,000
Yield per acre	—144	—42	—49

In addition 22,000 lbs. of sun cured leaf were produced in the Eastern Area and 600 lbs. of Turkish leaf in the Railway Belt.

Coffee.

13. At Abercorn there was a further decline in coffee acreage due to abandonment and only about 200 cwt. of hulled coffee were produced. The appearance of *Antestia* was recorded for the first time in Abercorn estates. Fort Jameson production was 100 cwt.

Agricultural Shows.

14. The Northern Rhodesia Agricultural Society's Show at Kafue was the most successful for many years. Tobacco exhibits by the Co-operative Society were outstanding. The department staged models illustrating the reclamation of worn out lands.

15. Native Shows were held in the Northern, Southern, Eastern, Central and Barotse Provinces. The department was only able to participate in the first three. All the shows were stated to be successful and successful they undoubtedly were in that " a good time was had by all ". If, however, the ultimate object of an agricultural show is the advancement of agricultural prosperity, it may be doubted whether the effect of these native shows is in any way commensurate with the immense amount of trouble and the expenditure (including expenditure which does not figure in the balance sheets) they involve. The connection between a good exhibit and a good garden is too attenuated, in fact where European farms adjoin native areas there may be no connection at all. Where agricultural extension work is in progress it is suggested that the award of really substantial prizes for the best gardens would be cheaper, less onerous and far more effective than a show in bringing about real improvement.

The Red Locust (*Nomadacris septemfasciata*).

16. In January and February Red Locust swarms were confined to Mwinilunga district. During March, April and May no flying swarms were observed but hopper bands were present in the Mwinilunga and Broken Hill districts. These bands were small, they caused little damage and it was reported that by the end of May those in Mwinilunga district had been completely destroyed.

17. During June and July a few young swarms, most of which entered the Territory from the North, were observed in Mwinilunga, Abercorn and Kasama districts. From early August until the end of October no swarms were reported.

18. From early November onwards there was marked activity. Swarms, most of which apparently came from the east, were fairly numerous in the Central, Southern and Eastern Provinces. Before the end of the year hopper hatchings on a very small scale were reported from Mazabuka district.

The African Migratory Locust (*Locusta migratoria migratorioides*).

19. There was a further unfavourable change in the locust position when the African Migratory Locust reappeared after an interval of three years. This reinfestation is the result of increased breeding in West Africa and a movement into the East African Territories which has followed practically the same course as the previous invasion.

20. The first swarms of the present movement crossed the border from Tanganyika Territory into Abercorn district at the end of October. Invasion continued and by the end of the year the Abercorn, Isoka, Mporokoso and Kasama districts were infested and egg laying had begun. It seems practically certain that the swarms of the next generation will spread throughout a large part of the Territory.

THE WORK OF THE DEPARTMENT.

21. The year 1939 was to have been one of rapid expansion for the department. Four new Agricultural Officers, a Senior Assistant Conservator of Forests and four Agricultural Supervisors were to have been appointed and new departmental stations were to have been opened in the Southern, Central, Western and Eastern Provinces. The outbreak of war not only frustrated these plans but necessitated a rapid and drastic modification of existing programmes.

22. Shortly before the war began the four departmental reservists, Messrs. Fraser, Duff, Johnson and Burton were called to the colours. Mr. Fraser was subsequently released on health grounds and returned to the department. On the outbreak of war all other members of the department promptly volunteered for service with the Regiment or overseas but none has yet been permitted to leave.

23. The uncertainty as to the war strength of the department made a revision of policy imperative. It was decided to concentrate all officers, while they remained available, on work which would not be wasted even if it could not be carried through to completion. All experimental work from which early results could not be expected was suspended in favour of concentration on the putting into practice of results already obtained. In effect this meant the limitation of departmental effort to the reclamation and preservation of native areas in the Southern, Northern and Eastern Provinces.

24. Two welcome and well deserved promotions were made at the beginning of the year. Mr. W. Allan became Assistant Director and Entomologist and Mr. U. J. Moffat, Senior Agricultural Officer. Mr. T. G. Stangeways, Agricultural Officer, arrived on transfer from the Gold Coast at the end of July. Messrs. Mulliner, Howard and Mitchell were appointed as Agricultural Supervisors and Miss C. Nightingale as a temporary clerk. All these appointments were made before the outbreak of war.

25. After several years of work in the Territory the staff of the Empire Cotton Growing Corporation was withdrawn. Mr. Bebbington was seconded to Tanganyika Territory and his assistant, Mr. Fowke, joined the N.R.A.S.C. Mr. Fowke was later released for service as an Agricultural Supervisor. The termination of the Corporation's work in this territory is greatly to be regretted though it must be admitted that it has gone as far as local cotton growing prospects could possibly justify. While there is yet little cotton to show for the time and money expended, the long collaboration between the Corporation's staff and the Entomologist has been productive of much work of wider application, notably in a clarification of the interaction of stainers, wild host plants and cotton. The generous attitude of the Corporation in continuing this work, even after it had become apparent that a commensurate reward would not be reaped in Northern Rhodesia, is greatly appreciated.

26. Forestry continued to be administered as a sub-department. The year's work is recorded in Part II of this report.

Ecological Survey.

27. Early in the year the Ecologist was invalided and granted extended leave in order to work up his field notes and maps of the areas in North Eastern Rhodesia which had already been traversed. Field work was consequently suspended.

Refugee Settlement.

28. I was chairman of a local committee appointed to collaborate with a visiting Commission under Sir James Dunnett, which arrived in April to investigate the scope of refugee settlement on the land. While the enquiries dispelled several somewhat irresponsible statements on the absorptive capacity of the territory, scope for limited settlement was found but it was shown that the cost per family would be high if success were to be reasonably assured. The Commission and the local committee issued reports which were substantially in agreement on the main issues.

Flue Cured Tobacco.

29. No experimental work was conducted on flue cured tobacco but all tobacco lands were cropped in accordance with the rotation devised at the Fort Jameson station. Seed was selected for sale to planters. It had been intended to start a series of fertilizer trials during the year but this project was suspended on the outbreak of war.

Native Grown Tobacco.

30. The trials at Minga were extended to 52 growers and, on the advice of Capt. Hornby, were limited to air cured Burley. Communal seed beds were established but these were not altogether successful and there was some shortage of seedlings for making good the depredation of insect pests. The season was somewhat unfavourable but over 5,000 lbs. of leaf were purchased at prices varying from 1½*d.* to 4*d.* per lb., with an average of 2¾*d.* The average return per grower from a half-acre plot was £1 4*s.* 0*d.* The corresponding figure for the previous year was £2. 2*s.* 8*d.* and some dissatisfaction was registered. That this was more vocal than real is shown by the fact that 173 growers came forward in the new season. Very few of the old growers dropped out. The tobacco was graded departmentally and sold at a price which covered all costs except those of supervision.

31. From the experience gained during two years of trial it was evident that a serious effort to expand the industry would involve resident European supervision. The Native Development Board therefore made a grant of £1,160 to cover expenses (other than European salaries) for a three year period. It was estimated that two thirds of this grant would ultimately be refunded from the proceeds of sales. An Agricultural Supervisor, Mr. Mulliner, was installed at Minga where he built a house. A scatter of department seedbeds was substituted for the communal ones of the previous year and seedlings were sold to intending growers. This system proved much more satisfactory. Excellent stands were obtained and the new crop promised well at the end of the year. Attention was also paid to the development of groundnuts as a cash crop for the area. Sixteen tons were sent to the railway line during the season and there are prospects of considerable expansion.

Coffee.

32. There is little to report from the Coffee manurial trials this year as certain treatments had been modified. The work was continued but it will be necessary to consider carefully whether, in view of the decline in number and acreage of local estates, it should not be wound up when the next crop has been reaped.

Cotton in Plateau Regions.

33. In the railway belt the crop was a complete failure owing to the incessant rain in the early part of the year. Since the institution of Maize Control the attraction of cotton as a crop has been confined to its rotational value and it is doubtful whether its value in this respect greatly exceeds that of groundnuts and beans which

are equally saleable and more popular. In these circumstances no further effort will be made to develop production for the time being, but for observation purposes small plots will be grown in departmental demonstration gardens.

34. At Mumbwa the season was a little better but still the yields were the lowest recorded from this area. After three years of trial, two of which were quite remunerative, growers remained lukewarm even though cotton provides a much needed cash crop. There were about 200 somewhat reluctant growers this year and the prospect of expansion beyond this number proved slender. As costs of supervision greatly exceeded the return to the growers, operations have also been suspended in this area.

Cotton in Valley Regions.

35. In contrast with the situation on the plateau, cotton was highly successful in both valley regions. In the Zambesi Valley the average yield was 463 lbs. seed cotton per acre and would have been considerably in excess of, perhaps even double, this figure had not the growers got tired of picking. There were 145 growers but the majority were only willing to cultivate minute plots. Although more work on pests is necessary, it is clear that this area is one of the most promising from a cultural aspect. The indolence of the inhabitants is notorious but this might yield to propaganda in time. However, a careful survey of the valley revealed that production on a scale which would warrant the erection of a commercial ginnery could only be secured if inhabitants on both the Northern and Southern Rhodesian sides of the Zambesi were to participate. This project was being considered in collaboration with the Empire Cotton Growing Corporation when war broke out but it had then to be suspended. The supervision of the Northern Rhodesia area is exceedingly difficult and expensive on account of the precipitous hills which cut off the valley from the Railway Line, and it was felt that, for the time being, available staff could be used to greater advantage in other directions.

36. For the third successive year the cotton season in the Luangwa Valley was a good one. 250 growers produced nearly 72,000 lbs. of seed cotton of which 85 per cent. was first grade. The average return per grower was 18*s*. but some realized over £5. Keenness is becoming manifest and the number of growers in the current season is over 700. It is stated that the proportion of absentee males in the area has fallen from 70 to 40 per cent. since cotton has been introduced as a cash crop. It cannot be claimed that this is entirely the result of cotton development, in fact it appears that the number of additional resident males is greater than the total number of growers to date, but it is understood that several men have returned to their villages to see whether cotton growing will afford sufficient attraction. A permanent storage shed, a small power gin and a half density baling press have been purchased and installed in the area with the aid of a grant made by the Native Development Board. It is hoped that this equipment with some minor additions will suffice to deal with the crop until it is developed to an extent which would warrant the erection of a commercial ginnery.

Beeswax.

37. Figures for the total exports of beeswax during the year are not yet available. The declared value of exports in the first nine months of the year was £1,700 and it is probable that the total production equalled or exceeded the 1938 output of 670 cwts.

38. At least in some parts of the new producing areas the wax season was considerably worse even than that of the previous year. The experimental work which was continued at Mumbwa shows clearly that this was due to exceedingly weak swarming and indicates the extreme fluctuations which may be expected in areas where production is dependent on the flowering of a single species of bee tree. During the late months of 1937 when the experimental work was started there was very strong swarming. In 1938 the flowering of Mutondo (*Isoberlinia paniculata*), the major " bee tree " of the area, was poor and swarming was weak. In 1939 Mutondo flowered well but the flowering period coincided with dull wet weather during which the bees did little work ; consequently colonies were greatly weakened and swarming was very poor. If the degree of swarming in 1939 be regarded as unity, then the amount of swarming in 1937, 1938 and 1939 was in the ratio 10 : 3 : 1. As a result of this decrease the percentage occupation of hives put up in 1938 was

small, probably about 10 per cent., while the swarming of 1939 was hardly sufficient to offset the loss of colonies caused by grass fires and by natural enemies which found the weakened colonies an easy prey.

39. Fortunately these disastrous conditions were not general. They are probably typical of the greater part of Mumbwa district and adjoining areas where the honey flow is derived almost entirely from Mutondo, but in the neighbouring districts of Mankoya and Kasempa the year was a satisfactory one and good progress was made. A number of other districts also made good progress during the year in improving the quantity and particularly the quality of the beeswax produced.

Kanchomba Experiment Station.

40. The rotation experiments were continued but gave little new information The second maize crop after cotton and groundnuts respectively showed no significant increases in yield over the controls. This, however, does not definitely prove that there is no residual effect on the second maize crop ; indeed in the case of groundnuts, at least, there is reason to believe that there may have been a fairly substantial effect which, under the conditions of the experiment, was masked by soil heterogeneity.

41. A new composite experiment has now been laid down. This experiment is designed to test the arbitrary rotation (Maize manured ; Maize ; Groundnuts and Beans ; Maize) at present in use, to ascertain the effect of individual factors and to compare the effects of compost and kraal manure. The results of the 1938-39 season gave an estimate of the effect of compost and kraal manure, both applied at the rate of 8 tons per acre, and a comparison between the two. The soil on which the experiment is laid down was on the poor side though typical of many native maize gardens and it reacted markedly to both manure and compost. The significant increases in yield were of the order of 75%. There was no significant difference between the effects of compost and kraal manure.

Lunzuwa Experiment Station.

42. The Chitemene experiments at Lunzuwa are designed to assess the advantages of burning of typical " chitemene " soils and to ascertain how, and for how long, these poor soils can be made to yield economically. Former results showed that the effect of a single burn on Male (*Eleusine coracana*) persists for at least three seasons. This was confirmed during the year. The effect of a previous burn is less marked with groundnuts and is apparently absent with sweet potatoes. Beans are slightly more responsive than groundnuts.

43. There are no new results of interest from the dambo-fringe experiments except that non-experimental plots on this type of soil produced surprisingly large crops of maize and wheat (Kenya B. 156). The maize yields were over 8 bags per acre and those of wheat 7 bags.

44. During the year the Government school was transferred from Abercorn to Lunzuwa in order that its work may, as far as possible, be correlated with that of the department.

Shiwa.

45. The experimental plots at Shiwa were continued under the kind supervision of Mrs. Gore-Browne. The majority cannot yield results for a year or two. Mrs. Gore-Browne has undertaken the supervision of two departmental demonstrators in the Shiwa area in addition to experimental work.

Reclamation and Preservation of Native Areas.

46. For reasons which have been given in full in previous reports it is considered that the reclamation and preservation of native areas in the Abercorn and Isoka districts (Northern Province), in the maize belt (Southern Province) and in the Fort Jameson district (Eastern Province) are matters of such vital importance that the concentration of almost all departmental resources on this work is fully justified. Moreover as much of the work is, or should be, of a non-recurrent character, it could be interrupted without serious loss at any time and is thus particularly adapted to the war period during which civil work of whatever importance must be subordinated to ever changing military needs.

47. If such work is to be soundly planned it must be preceeded by exploratory phases. In the first place accurate knowledge of the often obscure problems of each area must be acquired. Secondly, means of overcoming the difficulties must be devised and tested and these means must be within the capacity of the native cultivators. Thirdly, improvements must be demonstrated widely and the full propaganda value of such demonstrations must be used. Finally, in co-operation with the Native Authorities, the improvements must be put into practice throughout the area. It is fortunate that the " lean years " of the department permitted concentration on the unspectacular first two phases. Even so the improvements which have been devised and tested probably fall far short of perfection ; it can only be claimed that they represent a great advance on current practice and that their general adoption will go far to reclaim and preserve the areas in which they are being introduced.

(a) *Abercorn and Isoka Districts.*

48. In these districts the basis of improvement is the controlled Chitemene scheme which was described in last year's report. Some 450 square miles in and adjoining Reserve V and 400 square miles on the Abercorn-Isoka border have now been brought under the scheme. Ninety village areas have been demarcated. In Reserve V the co-operation of the Native Authority has been wholehearted. This is doubtless the reward of some years of patient propaganda and of well placed confidence in the Senior Agricultural Officer who has been resident in the district since 1928. The few offenders against the simple rules essential for the success of the scheme were promptly and adequately dealt with by the Native Authority. The villagers of Reserve V provided no less than 10,000 man days of voluntary and unpaid labour for the cutting of boundary lines.

49. Combined with the control of the traditional system of food production, effort has been directed toward the increase of food supplies from hoed gardens in order to provide more and varied foodstuffs without increasing the drain on woodlands. In this matter the Native Authority has again co-operated by issuing an order that a minimum of 200 mounds per hut must be made and cropped. These gardens are being protected from erosion by the simple expedient of joining mounds at intervals to form permanent ridges running roughly along the contour. This rough and ready method is apparently quite satisfactory in these small and usually isolated gardens ; it is applied rapidly and involves little extra labour. Three departmental demonstrators have been employed to illustrate how hoed gardens can be used to the best advantage.

(b) *The Maize Belt.*

50. In this area the urgent need is to ensure the continued productivity of the very limited amount of land from which, due to its geographical position and fertility, the present prosperity has been built up. This prosperity is already declining. It is first necessary to arrest erosion caused by indiscriminate ploughing and soil exhaustion and then to build up and maintain the fertility of gardens protected from erosion. The work has barely proceeded beyond the demonstration state at present and, indeed, no rapid progress can be expected unless adequate funds for soil conservation work can be made available from one source or another. Expenditure will inevitably be heavy. The gardens are large and, in most areas, continuous, thus their protection is beyond the means of the individual cultivator. It cannot be doubted, however, that expenditure even of the order of £100,000 will be well worth while. If it is not incurred fully half the Native agricultural income of the whole Territory will be lost (so productive is this favoured area) and a thriving business will revert to little more than subsistence.

51. As a preliminary, an aerial photographic survey of the main part of the maize producing area was completed during the year. The survey was financed by a free grant from the Colonial Development Fund and was carried out most efficiently by the Aircraft Operating Company of South Africa. An excellent series of overlapping vertical photographs covering 2,400 square miles of country was obtained. These provide data on which a complete scheme of soil conservation and general remedial work will be based. Collection of data and the preparation of maps is being undertaken departmentally and this work has already been completed for 1,000 square miles of the area surveyed.

52. Pending the inauguration of a complete scheme, demonstration and propaganda has proceeded actively in the area which can be supervised from the agricultural station at Kanchomba. The number of departmental demonstrators has been increased from one to six, but an unexpected development in the situation has made still further demonstration unnecessary in the Kanchomba area. The success of the first demonstration garden during two disastrous crop years was so impressive that an embarrassingly large number of cultivators implored the Agricultural Officer to aid their efforts at emulation. Of these applicants 20 suitable men were selected. Their gardens were protected from erosion by contour ridges, grass strips or a combination of strip and ridge. The applicants were required to apply manure to a portion of their maize and generally to carry out departmental instructions. At the time of writing, the results are most encouraging and the wide scatter of improved gardens cannot fail to pave the way to general improvement.

53. Here again the co-operation of the Native Authority has been most helpful in securing the return to grass of certain badly eroded lands which should never have been broken up and in discouraging the formerly almost universal practice of up and down hill ploughing.

54. As a subsidiary to the general programme of checking erosion and increasing fertility, the department has experimented in the development of cheap wheeled transport to take the place of sledges. Six scotch carts (four of which were the personal property of Mr. Clothier) were constructed, two on new Dunlop A.D.V. axles and four on old motor axles. All were fitted with pneumatic tyres. These vehicles were in constant use for several months in the Reserve and gave most satisfactory service. The only troubles were occasional broken booms and three punctures. The latter were confined to the old motor tyres. An impressive parade was staged at the Kanchomba Agricultural Show when the six fully-loaded carts, placarded with prices, and each drawn easily by two oxen preceded six beasts struggling to draw half the load on a native sledge. The cost prices ranged from £9 10*s*. for the simplest vehicle (a cart constructed on a second-hand axle and fitted with a pole bottom and sides laced with bark rope) to £18 for a new A.D.V. axle mounted with galvanised iron bottom and sides. The vehicles excited a good deal of interest. Enquiries were many but money was short and buyers were coy. Two carts have since been exchanged for oxen and this method of disposal may prove more fruitful than sale for cash. It has obvious advantages in overstocked parts of the Reserves. Wider ownership of carts must be encouraged in order to stop the scouring of roads and tracks by sledges and to facilitate the transport of manure to the gardens.

(c) *Fort Jameson Reserves.*

55. For a number of reasons beyond the control of the department, reclamation work in Fort Jameson Reserves has not proceeded as far as in the other two areas. Pressure on the land is greater than anywhere else in the Territory and the remedy of intensive cultivation will not be easy to apply. The greater part of the available land must be devoted to food crops, and supplies of manure or even of compost may be inadequate on account of the shortage of cattle. Nevertheless some improvement can be brought about by control of erosion, crop rotation and the use of what manure is available. Ten departmental demonstrators were established in Reserve II during the year. These men, in addition to cultivating their own gardens, have done a good deal in conserving supplies of manure in the villages and have planted large numbers of mangoes throughout the Reserve.

Agriculture in Schools.

56. Considerable progress was made during the year in the evolution of a policy for agricultural education based on the actual needs of the several areas of the Territory. An African Education Advisory Board sub-committee under my chairmanship put forward the view that in the Northern Province, which comprises about one-third of the Territory, the main agricultural problem (that of malnutrition) could best be tackled through the medium of schools. Not only is instruction in production of subsidiary crops of special food value particularly adaptable to school gardens, but in boarding schools, of which there are several in the Province, the equally important need for inculcating an urgent desire for better feeding can receive attention. The latter aspect of the nutrition problem is apt to be overlooked. The sub-committee recommended that Senga Hill School, where agriculture has always had a prominent part in the curriculum, should become a centre for the training of teachers of all denominations in order that every suitable school

in the Province should ultimately have one certificated teacher competent to work toward the achievement of a better diet. This recommendation was adopted by the Central Advisory Board and later by Government.

57. In contrast, the maize areas of the Southern Province present an entirely different problem. Here agriculture is not merely a means of subsistence, it is a profitable business. Nutrition is already on a fairly satisfactory plane and will undoubtedly improve with increased prosperity. In this area there is little relationship between school vegetable gardens and local needs. A high proportion of pupils will become maize farmers on leaving school and if their education is not to be divorced from their future life they must be taught maize farming while at school. A modest start has already been made on these lines in the Kanchomba area under the supervision of the Agricultural Officer.

58. In the Eastern Province the problem is similar to that in the Maize belt, but with the modification that the possibilities for economic development are far more restricted and that ploughing is never likely to become general. The pressure on the available land is such that cultivation must be as intensive as circumstances permit and the preservation of soil fertility is of more than ordinary importance. Here again something can be done through the medium of schools in demonstrating the value of manure, crop rotation and anti-erosion measures, though, as the majority of the higher educated ex-pupils will not be content with subsistence farming, the schools are not likely to play more than a minor part in agricultural improvement. A model farm has already been started under departmental supervision at the new Ngoni National School.

LEGISLATION.

Bush Fires Ordinance.

59. This Ordinance repealed the Bush Fires Prevention Ordinance 1920. In substitution provision was made for the prohibition of firing of grass except at certain seasons (in order to encourage the practice of " early burning ") and for the establishment of District Fire Boards. The Ordinance was applied to the Abercorn and Mazabuka districts and to the Machili Forest Area (Livingstone district) before the end of the year.

Maize Control (Amendment) Regulations.

60. These regulations provided that Class B maize should be contained in new 2½ lb. bags in lieu of sound second-hand bags. In addition, minor amendments were made to the scheduled area in which the Ordinance is operative.

Native Grain Trading Ordinance.

61. On account of local shortage of crops an order was made prohibiting the trading of grain, except under permit, in the Fort Jameson and Serenje districts.

REVENUE AND EXPENDITURE.

62. The recurrent expenditure of the Department, exclusive of Forestry and Ecological Survey and of the grants received from the Native Development Board, but including the entire administrative charges, has been roughly as follows in recent years :

	1934	1935	1936	1937	1938	1939
Administrative and Clerical ...	£1,500	£1,500	£1,500	£1,500	£1,600	£2,600
European Officers Employed	2	2	2	2	2	4
Field Work	£3,000	£4,000	£5,000	£6,000	£7,400	£9,400
European Officers Employed	3	3	4	4	5	10
Total	£4,500	£5,500	£6,500	£7,500	£9,000	£12,000
Total European Officers Employed	5	5	6	6	7	14

63. " Special Expenditure " of the order of £2,500 was also incurred. This covered the cost of the Ecological Survey, temporary buildings, motor vehicles and some minor non recurrent items.

64. In addition, the following grants were made by the Native Development Board :—

	£	
Tobacco development	1,160	for a three year period.
Cotton development	2,556	for a three year period.
Chitemene control	401	
Scotch cart experiments	80	
Improvement of Maize gardens	45	

65. Revenue from the sales of agricultural produce amounted to some £600 and a grant of £424 was generously made by the Empire Cotton Growing Corporation for work on pests of cotton.

PART II—FORESTRY.

66. It is estimated that roughly two thirds of the total area of Northern Rhodesia is covered by tree growth. The department can deal directly only with a very small proportion of this vast forest area of over 190,000 square miles. Its activities are concentrated in the two areas of greatest economic importance—the settled portions of the Railway Belt and the Mukushi (*Baikiaea plurijuga*) forests in the south western corner of the Territory. Throughout most of the rest of the country the department can act only in an advisory capacity to the Administrative and other departments.

67. Little new work was attempted during the year and the outbreak of war seriously interrupted the work in the Northern Division. Two anticipated European appointments were not made and one Assistant Conservator has left for active service with the Northern Rhodesia Regiment.

Demarcation of Forest Reserves.

68. No new Reserves were proclaimed and one obsolete Protection Reserve of 15 square miles on the Luanshya River was abolished. Details of the present position regarding Forest Reserves are given in tabular form in the Appendix.

INDUSTRIES AND EXPLOITATION.

The Zambesi Sawmills.

69. The Company worked at full pressure throughout the year, employing an average of 98 Europeans and 4,110 natives. In October the exploitation of Situmpa Forest (Yeta's Forests Agreement) was completed, and logging operations were transferred to Kasika Forest in Sesheke district under the Sesheke Forests Agreement.

70. The volume of timber in the round extracted by the Company during the course of the year was as follows :—

Baikiaea plurijuga (Mukusi).

From Yeta's Forests (Lonze and Situmpa)	3,120,970 cu. ft.
From Sesheke Forests (Kasika)	325,590 cu. ft.
	3,446,560 cu. ft.

Pterocarpus stevensonii (Mwangura).

From Yeta's Forests	25,870 cu. ft.

The total output of sawn timber was 1,162,272 cubic feet, of which the following were the more important items :—

Railway sleepers, Rhodesian Railways	344,480 cu. ft.
Railway sleepers, South African Railways	374,136 cu. ft.
Mining Timbers	211,834 cu. ft.
Flooring	10,619 cu. ft.
Parquet flooring exported overseas	19,000 cu. ft.

Mining Timbers : Northern Division.

71. All local timber used by the Copper Mines was derived either from their own mineral holdings or taken free of charge, under rights conferred by the Mining Proclamation, from a Forest Reserve. No complete records are available of the

quantities used but it is estimated that the Mines' consumption of native timber, other than firewood, was at least 300,000 cubic feet. A large proportion of this was used in the round. Nchanga Mine reached a stage of development at which it began to use native timber in quantity, and the increasing cost of imported wood led to renewed interest in local supplies on the part of other companies. 40,000 cubic feet of mining poles were sold for export to the Belgian Congo.

Furniture and Joinery Woods : Northern Division.

72. The saw-mill at Ndola drew practically all its timber requirements from private land. The total Government sales of the better quality timbers amounted to 10,000 cubic feet, of which 2,600 cubic feet were cut by Ndola Municipality for compound construction. The balance was made up from the sale of individual trees to native sawyers.

Firewood.

73. Here again large but unrecorded quantities were cut by the Mining Companies on their own holdings. Government sales totalled 10,000 cords, of which only 3,000 cords were derived from Forest Reserves and 600 cords from the Lenje Native Reserve.

EXPORTS AND IMPORTS.

74. The following tables show the value (in country of origin) of the exports and imports of wood and manufactures thereof during recent years.

EXPORTS.

	1933	1934	1935	1936	1937	1938	1939
	£	£	£	£	£	£	£
Unmanufactured ...	11,634	20,903	25,964	31,498	40,167	41,196	
Partly manufactured	309	1,245	2,247	776	3,347	4,327	
Joinery	347	79	138	110	545	320	*
Furniture	6,222	1,039	428	996	733	807	
Other manufactures ...	4,538	1,351	1,677	1,937	2,410	2,431	
Railway Sleepers ...	31,291	39,557	74,476	107,633	101,059	127,183	
Totals	54,341	64,174	104,930	142,950	148,261	176,264	90,301

* 9 months only. Details not available.

IMPORTS.

	1933	1934	1935	1936	1937	1938	1939
	£	£	£	£	£	£	£
Unmanufactured ...	29,264	41,294	24,392	35,679	58,034	42,415	
Partly Manufactured ...	2,646	2,754	2,666	1,482	5,052	3,838	
Furniture	8,375	12,867	9,642	7,890	17,909	29,060	*
Joinery	1,867	4,202	4,167	2,873	11,264	17,300	
Other Manufactures ...	5,940	10,632	4,492	6,003	14,241	14,219	
Totals	48,092	71,749	45,359	53,927	106,500	106,832	82,881

* 9 months only. Details not available.

REVENUE AND EXPENDITURE.

75. Revenue and expenditure for the past nine years have been as follows :

Year	*Gross Revenue*	*Expenditure* *
	£	£
1930-31	850	1,854
1931-32	417	2,740
1932-33	423	2,997
1933 (9 months)	316	2,366
1934	693	2,298
1935	1,040	3,540
1936	1,345	3,250
1937	1,789	3,595
1938	1,902	4,666
1939 (estimated)	2,300	6,500

* No share of the cost of administrative headquarters of the joint departments is included in the table of expenditure.

76. Revenue from exploitation of the *Baikiaea* forests in Sesheke District accrues not to the Crown but to the Barotse Native Treasury. Agreement was finally reached as to the financing of the very considerable expenditure which will be necessary to preserve these forests during exploitation and during the long unproductive period which must elapse before they again become exploitable. It has been agreed that the Native Treasury shall receive £750 per annum during the period of the present lease and that the balance of revenue shall be held (and preferably funded) to provide for regeneration. Government had advanced money for the protection of the forests before exploitation began and pending the completion of the agreement. The present state of finances is as follows :

	Revenue from Timber Royalties.	*Departmental Expenditure.*
	£	£
1936	18	1,345
1937	1,652	1,387
1938	2,191	1,290
1939 (Estimated) ...	440	770

The fall in revenue in 1939 is accounted for by the fact that exploitation under this lease was suspended for nearly a year while a new logging line was being laid. During this period logging operations were confined to Yeta's Forests which are covered by a separate agreement. Revenue in a full year will be of the order of £4,000. The fall in expenditure is due to a decision to relieve the fund of cost of European salaries. For the first three years, half salaries of the European staff engaged on the work were charged to the fund.

DIVISIONAL OPERATIONS : SOUTHERN DIVISION.

77. The year was devoted to the supervision and protection of the *Baikiaea* forests and to the completion of a comprehensive survey of Barotseland.

Enumeration.

78. The 2½ per cent. enumeration survey of Yeta's Forests was continued. Stock maps are now being prepared for 28 square miles of Lonze Forest and for the Naluama and Luangula Forests which total some 26 square miles. There still remain 10 square miles of Yeta's Forests area to be enumerated. Before exploitation began in Sesheke District an enumeration survey of Kasika Forest and part of Monze Forest was undertaken.

Fire Protection.

79. The formidable work of fire protecting 224 square miles of *Baikaiea* forest in Livingstone District and some 260 square miles in Sesheke District was carried out with remarkable success. In Livingstone District only a few acres of forest were damaged by fire and about 5 square miles of poor forest suffered in Sesheke District. The protection of Situmpa Forest (Yeta's forest area) was the responsibility of the Zambesi Sawmills while exploitation was proceeding but, by arrangement, the work was undertaken departmentally at the expense of the Company. Formerly, internal fire guards were cleared under the early burning system but during the year this was abandoned in favour of hoeing narrow tracks on each side of the fire breaks and burning the grass between the tracks when it was thoroughly dry. This proved to be more expensive than early burning but it gave a much cleaner and more efficient fire break.

Slash Disposal.

80. When fire occurs in exploited forests most damage to growing stock is caused by the burning of the large quantities of crown and branch wood which unavoidably remain on the ground. Several methods of slash disposal have been tried but the most practicable proved to be the stacking of slash where it could do least harm if burnt. Seven square miles of exploited forest in Lonze and four in Situmpa were treated by this method.

Exploitation under the Sesheke Agreement.

81. On the transfer of logging operations to the Sesheke Forests in October, it became possible, under the terms of the new agreement, to ensure that exploitation should be carried out with more regard to the silvicultural requirements of the

forests. The minimum girth below which trees may not be felled has been raised from 40 inches to 47 inches at breast height. The sparing of trees between these girth limits will secure the production of adequate seed now and will provide heavy timber when the forests are re-exploited. In poorly stocked forests an adequate number of seed bearers, irrespective of their girth, are marked in advance of the felling gangs. Slash disposal has also received more attention and the damage caused to pole growth during exploitation has been greatly reduced by the levying of damages.

Roads.

82. The forest roads and tracks were maintained in a passable condition. Fourteen miles of new boundary motor road were stumped and cleared on the eastern edge of Situmpa Forest. The line for an all-weather motor road from Kataba Forest to the Mongu-Lusaka road was pegged and 114 miles were opened up with the assistance of the District Commissioners of Sesheke and Mankoya. This road brings Mongu within two days journey of the forest headquarters at Machili.

Forest Survey of Barotseland.

83. Mr. Martin spent four months in completing the survey of Barotseland for which the Native Development Board had made a grant of £100 in addition to the £150 granted in 1938. The object of the tours was the drawing up of a comprehensive forest policy for Barotseland and the tendering of advice on the means of carrying it out. All districts in Barotseland were visited and the more important areas were studied and mapped in detail. A report is now in preparation and this will be accompanied by topographical and vegetation maps which have already been prepared. The report will provide the information necessary to enable the Provincial Administration, with the assistance of a Native Authority Forest Service and a small trained staff of Forest Rangers, to undertake the conservation of the forest resources of Barotseland.

84. While the full programme of conservation will be held up until the report is available for consideration by the Administration, much of the work has already begun, for example :

(*a*) Native Forest Laws have been passed by the Central Native Authority and are now in force throughout Barotseland, excluding Balovale District.

(*b*) A Native Authority Forest Service has been established in Mongu-Lealui and Sesheke Districts. During 1938 the forest Indunas carried out early burning as a fire protection measure over the greater part of these districts and began the enforcing of the Forest Laws. The Forest Service in Kalabo District will shortly be appointed.

(*c*) The Forest Laws have been explained in all districts to the Indunas and people.

(*d*) Topographical and vegetation maps of Mongu-Lealui and the adjoining portions of Balovale and Kalabo Districts have been prepared from traverses made during tours and are available as prints from the Survey Department. Maps of other districts are now being traced for printing.

85. The survey dispelled any illusions as to the possibility of large scale exploitation in Barotseland outside Sesheke District, but the work undertaken and projected should ensure the conservation of the rapidly diminishing supplies of valuable timber for the inhabitants and the small local industries. Of equal importance, the acceptance of early burning as a policy and the steps which have already been taken to enforce it, should check the present great loss of soil fertility caused by fierce late fires and lead in time to greater food production.

DIVISIONAL OPERATIONS : NORTHERN DIVISION.

86. Owing to the incidence of leave and the outbreak of war, only one Assistant Conservator and one Forester were available during the greater part of the year. In consequence, existing programmes could only be maintained with difficulty and there could be no question of expansion of operations.

Fire Protection.

87. In production Forest Reserves, fire-protection was effected by early burning over a total of 110 square miles. In general this burning was fairly intensive, although areas under concentrated regeneration were given most attention. Kafulafuta Protection Reserve (137 square miles) was similarly protected but here burning was carried out much less intensively, little more than the boundaries and main traffic routes being fired. A further 24 square miles of exploitation areas on Crown Land and in Native Reserves were early burned in order to assist regeneration. These works were successful in preventing any serious fire-damage in the areas concerned.

Silviculture.

88. The cutting of saw-timber and poles is carried out under selective working, while clear-felling is generally practised in firewood coupes. In areas of *Brachystegia-Isoberlinia* woodland exploited for firewood or small poles, slash disposal and early burning seem to be the only measures normally required to ensure satisfactory natural regeneration. Much of this regeneration is of coppice or sucker origin and the thinning out of some of the shoots which develop on and around each stump has already been undertaken in a few of the more advanced stands. The more difficult problem of regenerating better quality forest from which the high grade species have been selectively exploited for saw-timber has not yet had to be faced, as all such large scale cutting has so far been carried out either on private land or on areas destined to come under Native cultivation. Coppice regeneration would not be satisfactory in such cases and from experimental evidence the development of seedling regrowth seems to be both slow and erratic.

Land Planning and Conservation Projects.

89. During the visit paid to the Northern Province in 1938, enquiries were made regarding the head-water areas of the Luangwa River, one of the largest tributaries of the Zambezi, in relation to reports of increased flooding in its lower reaches. Time did not permit of personal investigation, but the matter was taken up by the District Commissioner, Isoka, in whose district the Luangwa has its source. He submitted a very interesting tour report depicting the losing battle being waged by relict forest clumps against annual fires around the source of the Luangwa at an altitude of 6,000 to 7,000 feet in the Mafinga Mountains. It seemed clear that this important head-water area was urgently in need of forest protection, but as it lay within Native Reserve it could not be declared a Forest Reserve without first being excised from the Native Reserve, a step to be avoided if possible. The interests involved are of much more than local character, so to secure immediate results a simple plan of fire-protection was drawn up and funds for its execution were made available to the District Commissioner. A successful start was made in 1939, and when staff conditions permit, a closer investigation of the whole area will be made.

90. The Swahili Reserve is by far the most densely populated Native Reserve outside the Eastern Province. It contains some excellent soil and its close proximity to Ndola and the Copperbelt offers the people a ready market for all the surplus food they can produce. The reserve is now heavily cultivated and the scarcity of fresh bush areas for gardens is becoming serious. Assistance was given to the District Commissioner in explaining the benefits which might result from the protection of young regrowth in abandoned gardens by early burning. The Chief then adopted a simple set of forest rules with such early burning as their main theme. He was further assisted in putting his rules into practice by the secondment of a Forest Guard to his own staff. These measures are far from sufficient in themselves to maintain the fertility of the soil, but they should help by reducing, as far as possible, the period of bush fallow between successive crops.

91. The District Commissioner, Broken Hill, was assisted in a scheme to organise early burning around the headwaters of streams in Chitanda's area. The Chief's nominee was given some general training at Ndola.

Research.

92. The sample plots, termite resistance trials and the Ndola experimental areas for fire-protection, early burning, slash disposal and improvement felling were maintained.

93. Several new species were added to the trial plantation plots. Small plots of *Gmelina arborea*, *Acrocarpus fraxinifolius*, *Azadirachta indica* and *Melia azedarach* were planted at the end of the year. The existing plots of Pines and indigenous species were blanked up and some were extended. Excluding a number of species which have already been cut out or abandoned as failures, a total of 44 species are now included in these plantation trials—12 indigenous species, 22 *Pinus spp.* and 10 other exotics. Most of these are represented by two or more plots, of which the total at Ndola is now over a hundred. These range in size from 0.1 to 6.0 acres. A more limited series of Pines are also under trial at Mwinilunga, in Nkana C Area and in Sichyele Forest Reserve. Every opportunity is taken to distribute promising new species among private applicants.

94. Among indigenous species *Albizzia gummifera* has reached an average height of 15 feet in 6 years from spot sowings. *Erythrophloeum africanum* now averages 10 feet in the same time while *Afzelia quanzensis*, although equally easy to establish by spot sowings, has grown only 5 feet in 6 years. The two Meliaceous trees *Khaya nyasica* and *Entandrophragma caudatum*, show good growth and vigour but in open plantations are consistently killed back by a shoot-borer. The most valuable native timber, *Pterocarpus angolensis*, still defies all efforts at satisfactory establishment by artificial methods. Most indigenous species seem to benefit as much as the exotics from fairly intensive methosd of cultivation. During the year a " rab " experiment was started in which representative native and exotic species were planted or sown in the sterilised patches on which heaps of branch-wood had been burned after the exploitation for firewood of an area in Ndola West Forest Area.

95. Not unexpectedly, many of the Pines, particularly *P. caraniensis*, *P. halepensis*, *P. pinaster* and *P. pinea* have proved unsuitable to local conditions. Slight variations in the intensity of the long dry season appear to make themselves felt very quickly on the more rapid growing species, and in 1939 all of these showed considerable browning and die-back of the top shoots. *P. leiophylla* developed best of the new introductions of the previous year. A three year old plot of *P. patula* has reached an average height of 12 feet and the yield from a thinning at the end of the year was in good demand as Christmas trees.

96. With few exceptions Eucalypts in the Copperbelt are invariably destroyed by termites. Conveniently situated plantations producing poles and firewood could show a good profit, but no thoroughly suitable species has yet been found. The search for a reliable and quick growing tree is therefore being continued.

97. New identified material was entered into the herbarium, which, apart from several troublesome genera, was reasonably up-to-date at the end of the year. Bark samples of four local species of *Strychnos* were supplied to an investigator attached to the New York Botanical Gardens for examination of their properties.

Advisory.

98. A considerable amount of time was spent, both on correspondence and visits, in giving advice to the public on tree-planting and other matters. Contact was also maintained with the principal mines in development of the utilization of native timbers. In particular, the Roan Antelope Mine was given assistance in reducing the damage caused by borers to their stocks of mining poles. On departmental suggestion Nkana Mine gave a trial to the Dehra Dun Frikiln for the production of charcoal. This has been an almost unqualified success and may lead to considerable extension of the use of charcoal on the mine. A talk and demonstration of local work was given to a gathering of Native chiefs of the Western Province at Ndola in June.

C. J. Lewin,
Director of Agriculture.

Mazabuka,
30th March, 1940.

APPENDIX.

AREA IN SQUARE MILES OF FOREST LAND ON 31ST DECEMBER, 1939.

Territorial Unit	Total Area of Unit	State Forest				Communal Forest				Private Forest	Total Forest Land	Percentage of Whole Area	
		Production Reserves	Protection Reserves	Unreserved	Total State Forest	Production Reserves	Protection Reserves	Unreserved	Total Communal Forest			Forest Reserves	Total Forest Land
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Southern Division (Barotse and Southern Provinces)	101,430	8	381	—	—	500	—	—	—	—	—	—	—
Northern Division (Eastern, Northern, Central and Western Provinces)	188,890	238	137	—	—	10	45	—	—	—	—	—	—
TOTAL	290,320	246	518	110,602	111,366	510	45	73,959	74,514	7,660	193,546	0.45%	66.6%

NOTE.—The totals of forest area in columns 6, 10, 11, and 12 are estimates on the basis that two thirds of the total land areas are forested.